

HRP Space Radiation Tissue Sharing Initiative

National Aeronautics and
Space Administration



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Investigators' Workshop**

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What is the problem?

What do we want to accomplish?

How do we implement?



Tissue Sharing Problem



HRP's Space Radiation Element is tasked with characterizing the risks of space radiation exposure on humans

- Many of the effects of these risks only present in a small subset of the population
- Need large sample sizes to fully characterize risk



Space Radiation Element funds rodent research to characterize and understand these risks

- These studies can result in excess tissues that are stored for later use
- Excess tissues could increase sample size if properly distributed





Tissue Sharing Goals



GOAL

- Utilize existing archives of saved tissue samples to increase scientific progress with minimal additional cost

GOAL

- Encouraging researchers to collect and preserve “unwanted” tissues in future animal experiments to maximize secondary scientific output

GOAL

- Maximize scientific output from large, chronic, low-dose rate animal experiments

GOAL

- Ultimately, be good stewards of US Taxpayer Research Dollars and understand the risks of sending a human to Mars



Increase n to improve power of study



- The statistical power of a study is related to the sample size in question. For example:

Situation	Sample Size to Estimate Confidence Interval	Sample Size to Conduct Test of Hypothesis
Continuous Outcome, One Sample: CI for μ , $H_0: \mu = \mu_0$	$n = \left(\frac{Z\sigma}{E}\right)^2$	$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{ES}\right)^2$ $ES = \frac{ \mu_1 - \mu_2 }{\sigma}$

- In many research proposals, the PI calculates the desired sample size, n, based on cost, feasibility, and desired statistical power of the study
- With the tissue sharing initiative, NASA seeks opportunities to increase sample size through already available tissues



Recall that for low dose rate studies, many effects may only exhibit in a small percentage of the population, so need a very large sample size for hypothesis testing



Tissue Sharing Implementation



- **Recall the goals:**

- Utilize existing archives of saved tissue samples to increase scientific progress with minimal additional cost
- Encourage researchers to collect “unwanted” tissues in future animal experiments to maximize secondary scientific output
- Maximize scientific output from large, chronic, low-dose rate animal experiments
- Understand the risks from sending Humans to Mars

- **Implementation**

- Implement as a Phased approach — learning from different types of tissue sharing models and various levels of tissue sharing
- All tissue samples are stored at home institute and animals are sacrificed at NSRL or home institute
 - Pilot storing tissues at tissue archives as PI's retire
- Engage research community and collect lessons learned



Phased Approach to Tissue Sharing

Type I: Increase Ad hoc Tissue Sharing (PI to PI) of Existing Samples

- SR will facilitate sharing
- Provide database of existing samples with access through our SR website
- Actual transfer and agreements to be negotiated between PI's

Type II: Solicited Research using Inventory of Existing Tissue Samples

- Element led; Voluntary by Primary PI
- Solicit research that specifically uses available samples shared between proposing PI and primary PI's
- Agreement to share is negotiated between proposing PI and primary PI

Type III: Promote Sharing of Tissues from On-going Animal Studies

- Ad hoc and solicited (Element led); Voluntary by primary PI
- Inventory possibilities and advertise; Agreements in place prior to sacrificing animals;
- Goal: Practice how to maximize secondary science without interfering with primary science, timing, and logistics

Type IV: Mandatory Tissue Sharing on Large PI-led animal studies

- For studies involving large number of animals, SR will consider making tissue sharing mandatory
- NRA will specifically request a tissue sharing plan from primary PI indicating samples easily available
- SR will determine which projects should be considered mandatory upon award of grant

Type V: Element-led Chronic Animal Study – Solicited Research Topics with Multiple PI Studies

- Element defines large animal study parameters and solicits research
- Study parameters vetted with Working Groups and PI community



Phased Approach to Tissue Sharing

Phase I has been achieved

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Life Sciences Data Archive



- Space Radiation Tissues that are available for research can be found in the Life Science Data Archive
- <https://lsda.jsc.nasa.gov/>

NASA Life Sciences Data Archive HOME FOR RESEARCHERS FOR EDUCATORS FOR STUDENTS FOR EVERYONE

Experiment Mission Personnel Hardware Biospecimens Subject Documents Dataset Photo Gallery

NASA Research Announcement

NASA Research Announcements (NRAs) for Human Exploration Research Opportunities (HERO) and for Research Opportunities in Space Biology (ROSBio) can be found on the NSPIRES website.

NASA Human Research Program (HRP)

NASA's Human Research Program (HRP) conducts research and develops technologies that allow humans to travel safely and productively in space. The Program uses evidence from data collected on astronauts, as well as other supporting studies. These data are stored in the research data repository, Life Sciences Data Archive (LSDA).

More about HRP: HRP Home Human Research Roadmap Evidence Book Education & Outreach



How to use the Life Sciences Data Archive



- Start at <https://lsda.jsc.nasa.gov/>

The screenshot shows the NASA Life Sciences Data Archive website. The top navigation bar includes the NASA logo, the site name 'Life Sciences Data Archive', and links for HOME, FOR RESEARCHERS, FOR EDUCATORS, FOR STUDENTS, and FOR EVERYONE. Below this is a horizontal menu with icons for Experiment, Mission, Personnel, Hardware, Biospecimens, Subject, Documents, Dataset, and Photo Gallery. The 'Biospecimens' icon is circled in green, and a green box with the text 'Then, choose "Biospecimens"' and an arrow points to it. Below the menu, there is a section for 'NASA Research Announcement' with a link to 'NASA Research Announcements (NR...)'. Below that is a section for 'NASA Human Research Program (HRP)' with a description of the program and a large image of an astronaut in space. At the bottom, there is a footer with links for 'More about HRP: HRP Home | Human Research Roadmap | Evidence Book | Education & Outreach'.



How to use the Life Sciences Data Archive



- The result will be this search option:

Biospecimen Search

Biospecimen Name

Category Name

Subcategory

Protocol / Approach

Hardware Name

Experiment Title

Mission

Payload



How to use the Life Sciences Data Archive



- The result will be this search option:

Biospecimen Search

Biospecimen Name

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For best search results, use the drop downs at the left of the screen to narrow the dataset to items of interest



How to use the Life Sciences Data Archive



- The result will be this search option:

Biospecimen Search

Biospecimen Name

Category Name

Subcategory

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Step 1) Choose the
“Payload” Dropdown
box



How to use the Life Sciences Data Archive



- Under the Payload drop down, choose “NASA Space Radiation Lab (NSRL)”

Biospecimen Search

Biospecimen Name

Category Name

Bion 9 (Bion 9)
Commercial Biomedical Testing Module (CBTM)
Commercial Biomedical Testing Module-2 (CBTM2)
Directed Ground Study (Ground)
Human Health and Countermeasures (HHC) Tissue Sharing Program (TSP) (HHC TSP)
Immunology_Space Tissue Loss (Immune_STL)
Mouse Habitat Unit 2 (MHU_2)
Mouse Immune 2 (MI2)
NASA Space Radiation Lab (NSRL)
National Institutes of Health Rodents Experiment-2 (NIH.R2)
National Institutes of Health Rodents Experiment-3 (NIH.R3)
Neurolab (Neurolab)
Physiological and Anatomical Rodent Experiment-3 (PARE.03)
Rodent Research 1 (RR-1) Biospecimen Sharing Program (BSP) (RR1_BSP)
Rodent Research 3 (RR-3) Biospecimen Sharing Program (BSP) (RR3_BSP)
Rodent Research 4 (RR-4) Biospecimen Sharing Program (BSP) (RR4_BSP)
Rodent Research 5 (RR5) Biospecimen Sharing Program (BSP) (RR5_BSP)
Rodent Research 6 (RR6) Biospecimen Sharing Program (BSP) (RR6_BSP)
Rodent Research 7 (RR7) Biospecimen Sharing Program (BSP) (RR7_BSP)
Rodent Research 9 (RR9) Biospecimen Sharing Program (BSP) (RR9_BSP)



How to use the Life Sciences Data Archive



Biospecimen Search

Biospecimen Global Search

Reset Search

Biospecimen Name

Category Name

Subcategory

Protocol / Approach

Hardware Name

Experiment Title

Mission

Payload

Reset Search

Step 2) Choose the
"Protocol / Approach"
Dropdown box



How to use the Life Sciences Data Archive



- Under the Protocol / Approach Tab choose the desired Radiation Dose

Biospecimen Search

Dose: 1.0 Gy
Dose: 1.2 Gy x 5 daily
Dose: 1.88Gy
Dose: 10 cGy
Dose: 10 Gy
Dose: 10/1/10
Dose: 100 cGy
Dose: 15 cGy
Dose: 150 cGy
Dose: 1Gy
Dose: 2 Gy
Dose: 2.0 Gy
Dose: 200 cGy
Dose: 200cGy
Dose: 25 cGy
Dose: 3 Gy
Dose: 30cGy
Dose: 4 Gy
Dose: 4.7Gy
Dose: 400 cGy

Hardware Name
Experiment Title
Mission
Payload
NASA Space Radiation Lab (f)

Reset Search

Search Found Set:

Session Type	Storage Medium	Payload	Species / Strain			
Time point of sacrifice: Showing symptoms of lung tumor development		NSRL	Species: Mouse Strain:			
Time point of sacrifice: 7 days post irradiation		NSRL	Species: Mouse Strain: WT C57BL/6J			
Details	16140	Kidney	Dose: 0 Gy	270 days	NSRL	Species: Mouse Strain: C57BL/6J
Details	16215	Liver	Particle type: 16O Dose: 0.1 Gy	270 days	NSRL	Species: Mouse Strain: C57BL/6J
Details	12399	Kidney	Dose: 0.5 Gy Gamma Ray	90 days	NSRL	Species: Mouse Strain: C57BL/6J
Details	12569	Spleen	Dose: 1 Gy Gamma Ray	14 days	NSRL	Species: Mouse Strain: C57BL/6J



How to use the Life Sciences Data Archive



Biospecimen Search

Biospecimen Global Search

Reset Search

Biospecimen Name

Category Name

Subcategory

Protocol / Approach

Hardware Name

Experiment Title

Mission

Payload

Reset Search

Step 3) Choose the
"Biospecimen Name"
Dropdown box



How to use the Life Sciences Data Archive



- Under Biospecimen Name, choose the tissue type of interest

Biospecimen Search

Biospecimen Global Search

Reset Search

Biospecimen Name

Kidneys
Large intestine - piece 3
Larissimus dorsi
Liver
Liver - half
Liver - left lobe caudate piece 1
Liver - left lobe piece 1
Liver - left lobe piece 2
Liver - left lobe piece 4
Liver - left median lobe piece 3
Liver, embryonic
Liver, I.
Liver, Stomach, spleen
Liver- Left Median Lobe
Liver- It lobe
Liver- It lobe sec 1
Liver- It lobe sec 2
Liver- It lobe sec 3
Liver- Other Lobes
Liver- remainder

Payload

NASA Space Radiation Lab (I

Show 10 entries

Search Found Set:

	Biospecimen ID	Biospecimen Name	Protocol / Approach	Session Type	Storage Medium
Details	9891	Kidney	Energy: Cs 137 Particle type:	Time point of sacrifice: 2 months	
Details	16631	Lung, spleen, kidney, liver, proximal small intestine, thymus, heart	Particle type: Xray Energy: 320 kVp Dose: 2	Time point of sacrifice: 300 days post IR or showing symptoms	



How to use the Life Sciences Data Archive



- Alternatively.....

The screenshot shows the NASA Life Sciences Data Archive website. The top navigation bar includes the NASA logo and the text 'Life Sciences Data Archive', followed by links for HOME, FOR RESEARCHERS, FOR EDUCATORS, FOR STUDENTS, and FOR EVERYONE. Below this is a horizontal menu with icons for Experiment, Mission, Personnel, Hardware, Biospecimens, Subject, Documents, Dataset, and Photo Gallery. The 'Documents' button is circled in green. A green callout box with the text 'Choose the "Documents" button' points to the 'Documents' button. Below the menu, there is a section titled 'NASA Research Announcement' with a paragraph of text. Below that is a section titled 'NASA Human Research Program (HRP)' with a paragraph of text and a large image of an astronaut in a white spacesuit floating in space.



How to use the Life Sciences Data Archive



- Under “Document Search”, search “NSRL”

Document Search

NSRL

Reset Search

Experiment

Space Flight Mission/Ground-Based Study

Payload

Document Type

Reset Search

Show 10 entries Search:

	Document Number	Document Title	Document Type	Availability
Details	Doc13766	NASA Space Radiation Lab (NSRL) upcoming sacrifices	Project	Available online
Details	Doc13726	NASA Space Radiation Lab (NSRL) available biospecimens	Project	Available online

Showing 1 to 2 of 2 entries Previous 1 Next

Latest list of raw data that feeds the database



Sample Request Form



Life Sciences Data Archive

HOME

FOR RESEARCHERS

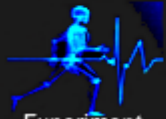
FOR EDUCATORS

FOR STUDENTS

FOR EVERYONE

Search LSDA

Search



Experiment



Mission



Personnel



Hardware



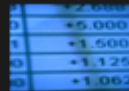
Biospecimens



Subject



Documents



Dataset



Photo Gallery

NASA Research Announcement

NASA Research Announcements (NRAs) for Human Exploration Research Opportunities (HERO) and for Research Opportunities in Space Biology (ROSBio) can be found on the [NSPIRES](#) website.

Submit Request



Data or Biospecimen Request

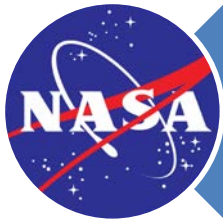
Images Added to the Archive



Tissue Sharing Storage Options



Currently, tissues are stored at individual PI Institutions



As PI's retire, ask to move tissue samples to JSC



SRE has identified space for tissue storage



Long term, SRE will establish a tissue storage archive

Questions?

